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OFFICE OF THE SECRETARY

December 22, 1999

EX PARTE OR LATE FILED

Ms. Magalie Roman Salas, Secretary
Federal Communications Commission
The Portals, TW-A325
445 12th Street, S.W.
Washington, D.C. 20554

Re: Ex Parte Notification - WT Docket 99-168

Dear Ms. Salas:

This letter provides information regarding out-of-band emission limits proposed by the Federal Law Enforcement Wireless Users Group (FLEWUG) to protect public safety operations in the 700 MHz band. There are a number of important points that FLEWUG makes in its December 9, 1999 Ex Parte filing that Motorola would like to clarify and expand on. The undersigned discussed the contents of this letter with Martin Liebman of the Wireless Telecommunications Bureau on December 20 and 22 and with Julius Knapp of the Office of Engineering & Technology on December 22.

In its December 9 filing, the FLEWUG indicates support for Motorola's proposal that bands immediately adjacent to the public safety frequency bands at 764-776 MHz and 794-806 MHz be used for private land mobile services in order to minimize the potential for interference to public safety and make efficient use of the spectrum.¹ FLEWUG also expresses concern that, if low-power transmitters, such as those proposed by FreeSpace, are permitted in the bands adjacent to public safety, the number and location of such devices will be unknown and that public safety operations will be subject to the aggregate interference from a number of these devices.² FLEWUG also points out that some of the information submitted by FreeSpace in its Ex Partes appears to be inconsistent, making it difficult to conduct an accurate interference analysis.³

¹ See Ex Parte Communication of the Federal Law Enforcement Wireless Users Group, December 9, 1999 at paragraph 11.

² *Id.* at paragraph 13.

³ *Id.* at paragraph 14.

To protect public safety systems from Commercial Mobile Radio Service (CMRS) operations in the non-PMRS portion of the spectrum under consideration, FLEWUG proposes that emissions from these systems be attenuated in the 764-776 and 794-806 MHz bands in accordance with the following:

- 1) For transmitters with power levels above 1 Watt: $65 + 10\log(\text{Power})$
- 2) For transmitters with power levels below 1 Watt: 65 dBc (dB relative to the carrier)⁴

In a December 13, 1999 filing Motorola proposed that different out-of-band limits be applied at the three intersections between commercial and public safety operations in order to provide the protection necessary based on the different interference scenarios. The Attachment from the December 13 filing, showing Motorola's proposed band plan and associated out-of-band limits, is attached to this filing for reference. Based on Motorola's analysis, the limit proposed by FLEWUG of $65 + 10\log P$ is only appropriate at the one intersection at 764 MHz where CMRS mobiles could cause interference into the public safety base station receivers. The other intersections, where there will be base-to-base or base-to-mobile interference, must be protected to higher levels, with the specific levels dependent on the interference scenario.

Based on our discussions with FLEWUG, its analysis is based on a number of very system-specific assumptions leading to a recommendation that is 22 to 27 dB short of what is necessary at the base-to-mobile and base-to-base interfaces. A comparison of the FLEWUG analysis submitted December 9 and Motorola's analysis submitted December 2 for the base-to-mobile case illustrates why these protection values vary and why the Motorola analysis results in the appropriate protection for public safety.

The two analyses start with similar assumptions based on the noise floor of the public safety receiver and allowing a 1 dB degradation in receiver sensitivity. FLEWUG actually assumes a lower current noise floor and starts its analysis with a stricter limit of -134 dBm compared to Motorola's value of -132 dBm.

There is a significant difference of 13 dB between the analysis of Motorola and FLEWUG for the path loss between the base transmitter and mobile receiver. FLEWUG assumes a very specific path scenario with a horizontal separation of 250 meters and a vertical separation of 50 meters between the CMRS base transmitter and the public safety mobile. FLEWUG uses a theoretical formula based on TIA developed, technical service bulletin TSB 88 to calculate path loss between the base and mobile. This theoretical formula is based on free space loss plus attenuation due to clutter, Fresnel loss, and reflection. Using this formula, FLEWUG calculates the free space loss and adds a 10 dB loss due to local clutter and, based on this specific, theoretical case, calculates a path loss of 88 dB.

Motorola, on the other hand, uses both theoretical and actual measured isolation from previous interference studies to more accurately represent the attenuation that can

⁴ *Id.* at paragraph 8

be expected between the base transmitter and the mobile receiver. In its December 2 filing, Motorola provides measured data from 17 Nextel sites showing that the path loss realized with 95% probability between 600 to 1000 feet from the transmitter site is 75 dB. This real-world measured data is further supported by Garry Hess in his book, *Land Mobile Radio System Engineering*.⁵ In addition, the chairman of the TIA committee that developed TSB 88, Mr. Bernie Olson, was consulted with respect to FLEWUG's application of a 10 dB clutter factor. Mr. Olson reports that the clutter factor is normally not available in the instances of interference seen in the field. Direct line of sight paths prevail for the distances being considered here. The clutter loss is generally only applied at fairly large distances to allow for the additional losses of the wave front penetrating the local environment. Accordingly, the clutter factor accounts for 10 of the 13 dB difference. The other 3.0 dB is due to FLEWUG's use of a very specific path distance of 836 feet⁶ as opposed to Motorola's use of real world data demonstrating that there is a 95% probability that the path loss between 600 to 1000 feet will only be 75 dB.

There is a 5.1 dB difference because FLEWUG did not normalize its reference power to 1 W, as is necessary for the protection levels to apply to a general case. Normalizing the reference power to 1 watt gives 30 dBm, whereas FLEWUG uses 24.9 dBm. The use of a non-normalized value by FLEWUG confuses the calculation results, which should have been adjusted accordingly. Failure to normalize the calculation makes the end result highly dependent on the transmitter power level assumed and the assumed antenna gain and is only applicable for a single case. Accordingly, the protection level proposed must be normalized to eliminate the 5.1 dB discrepancy. FLEWUG also assumes 2 dB of cable loss, whereas Motorola assumed no loss, because the actual loss will depend on deployment. Finally, FLEWUG appears to perform a significant rounding of 3.9 dB to go from the calculated attenuation requirement of 68.9 dB to the 65 +10logP attenuation that FLEWUG is proposing.

Summary of Analysis

	FLEWUG	Motorola	Variance
Target Interference Level	-134 dBm	-132 dBm	-2 dB
Clutter loss	10 dB	0	10 dB
Other path losses (single case analysis v. general case analysis)	3 dB	0	3 dB
Cable losses	2 dB	0	2 dB
Reference Power	24.9 dBm	1 watt	5.1 dB
Rounding	-3.9 dB	N/A	3.9 dB
Total Variance			22 dB

⁵ See Footnote 3 of letter from Leigh Chinitz to Magalie Salas, December 2, 1999, referring to Garry C. Hess, *Land Mobile Radio System Engineering*, Archer House, 1993, page 16.

⁶ FLEWUG assumes a horizontal distance of 250 meters and a vertical distances of 50 Meters. This yields a path length of 255meters, or 836 feet.

Similar discrepancies can be found in FLEWUG's analysis with respect to the mobile-to-mobile interference case. However, based on Motorola's analysis demonstrating that the mobile-to-mobile case presents an extremely severe interference problem, Motorola has proposed to reverse mobile and base transmit bands of the public safety service and to follow a similar plan for other services in this band. Under Motorola's proposal to reverse the transmit and receive bands, the mobile-to-mobile case no longer applies.

FLEWUG did not perform any analysis for the base station transmit into the public safety base station receiver. As explained in Motorola's December 13 filing, this case presents a very different scenario from the base-to-mobile case, since there is a greater probability of the two sites being in direct line of sight. Accordingly, Motorola recommends an out-of-band limit of $92 + 10\log P$ to afford the necessary greater protection.

FLEWUG also attempts to provide interference analysis for FreeSpace interference into public safety. However, as FLEWUG clearly states, information provided by FreeSpace about its proposed operation is inconsistent, making an accurate evaluation difficult. The FLEWUG analysis with respect to FreeSpace contains a number of very generous assumptions that lead to extremely optimistic and insufficient protection levels. FLEWUG allows almost 7 dB of additional interference based on a 20% duty cycle for FreeSpace. However, a 20% duty cycle does not spread the power transmitted when the unit is transmitting, it merely reduces the amount of time during which the system transmits. Thus the public safety user will still experience interference. It will, at best, just be cyclical, and if the cycle time of the FreeSpace system is very fast, the interference to a public safety user may still be continuous, or appear so. FLEWUG also uses a separation of 250 meters in its calculations and applied an even greater clutter factor than in the previous case. This results in an extremely optimistic path loss. Because of the low-power nature of the FreeSpace system, it is likely that transmitters will be densely deployed on low buildings, on low utility or light poles and within buildings. Thus it is very likely that there will be numerous cases where public safety receivers will be in close proximity to FreeSpace transmitters and where the overly optimistic assumptions used by FLEWUG will not apply. FreeSpace has not provided sufficient or consistent information to allow an accurate interference analysis, nor have any rules been proposed that would limit FreeSpace operations to those that would be consistent with any such analysis.


I also want to take this opportunity to provide additional clarification with regard to the interference analysis, resulting protection levels and rules proposed by Motorola. Motorola's interference analysis was conducted in a way that makes it independent of the transmitter power. For example, while Motorola proposed in the draft rules attached to its December 13 filing, that mobiles operating in the 747.5-762.5 MHz band be limited to a maximum of 7 watts, if the power level of these mobile units was increased, it would not affect the level of protection required for public safety systems at 764-776 MHz.

However, as described above and in its December 13 filing, Motorola's analysis is highly dependent on the type of interaction that can be expected between mobile and base receivers and transmitters. Accordingly, if fixed units were permitted to operate in the 747.5-762.5 MHz band, the protection limits proposed for the mobile-to-base case would no longer apply. Instead, we would be faced with a scenario much closer to the base-to-base case, for which Motorola proposed a limit of $92 + 10\log P$ and this should be the limit applied for any base-to-base interaction.

In closing, Motorola urges the Commission to limit out-of-band emissions to a level commensurate with that necessary to protect public safety based on Motorola's extensive real-world experience and analysis. As pointed out by FLEWUG, no such analysis is possible in the case of services proposed by FreeSpace.

In you have any questions with regard to this filing, please contact the undersigned at (202) 371-6953.

Sincerely,



Steve B. Sharkey

Attachment
Cc:
James Schlichting
Martin Liebman
Jay Jackson
Julius Knapp
Herbert Zeiler
Ron Netro
Kris Monteith



Attachment 1 - Band Plan

